

I. **Rule R647-4-104 - Operator(s), Surface and Mineral Owners**

1. **Mine Name:** Skull Valley Diatomaceous Earth Quarry

2. **Name of Claimant and Operator:**

**Claimant - Castle Rock Land and Livestock LLC Operator - Holcim (U.S., Inc.)**

Company ( )    Corporation (x)    Partnership ( )    Individual ( )

A corporation must be registered with the State of Utah, Division of Corporations.  
Are you currently registered to do business in the State of Utah? YES

Business License #000078, Issued 1/08/2004 by Morgan County For List of Corporate Officers see pg.

3. **Permanent Address:**

**Operator**

Holcim (U.S., Inc.) - Devil's Slide Plant  
6055 East Croydon Road  
Morgan, Utah 84050  
Phone: (801) 829-6821  
Fax: (801) 829-2100

**Claimant**

Castle Rock Land and Livestock LLC (i.e.) (CRLL)  
139 E. South Temple, Suite 310  
Salt Lake City, Utah 84111  
Phone: (801) 328-1600  
Fax: (801) 328-1616

4. **Company Representative:**

**Operator**

Ken George  
Quarry Manager  
Holcim (U.S., Inc) - Devil's Slide Plant  
6055 East Croydon Road  
Morgan, Utah 84050  
Phone: (801) 829-2153  
Fax: (801) 829-2100

**Claimant**

Christopher Robinson  
Manager  
Castle Rock Land and Livestock  
Salt Lake City, Utah 84111  
Phone: (801) 328-1600  
Fax: (801) 328-1616

Approved

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### **III. Rule R647-4-106 - Operation Plan**

#### **106.5 Existing soil types, location of Plant Growth Medium**

A soil survey of the proposed disturbed areas will be completed in the summer following the approval of this permit and will be submitted as an addendum to the permit. The soil survey will provide recommendations on soil salvage and protection. Additionally, the survey will provide information about the physical and chemical nature of the soil, including information about the horizons within the rooting zone. The soil will be described according to standard soil survey procedures, and will be tested for parameters like sodium absorption ratio, electrical conductivity, texture, coarse fragment content, and nutrient levels (primarily N,P,K).

Until the survey is complete, the Operator proposes to continue removing the top 1-3 feet of PGM of disturbed areas and stockpiling the material above previously undisturbed areas with a PGM surface, adjacent and contiguous to the mine pit, as shown in Figure 105.4. The PGM will be reapplied to disturbed areas annually.

#### **106.6 Plan for protecting and redepositing soils**

The thickness of the soil and volume to be stockpiled will be described in the soil survey to be completed. Until this is completed, the Operator will remove PGM during mining and replace it each fall. The PGM (Plant Growth Medium) will be removed as described in Section 106.2. The PGM will then be temporarily stockpiled in multiple piles adjacent and contiguous to the mining area, as shown in Figure 105.4. Signs will be placed on the stockpiles, designating them as soil stockpiles, as recommended by the DOGM.

Erosion will be minimized because PGM will be reapplied and seeded directly after each mining campaign until reclamation is successful and the area released by the DOGM. In addition, the PGM contains vegetative debris that will help minimize erosion during stockpiling, and the stockpile will be of a topographic low. According to soil information provided by the NRCS, the PGM is subject to minimal water erosion. Should it be found necessary, additional and appropriate measures will be taken to control erosion.

The soil will be protected from weed infestation by planting an annual grain, recommended by the DOGM, in the spring to compete with the weeds. A semi-permanent vegetation cover will be established on the roads to protect those areas from weed infestation. The seeds used for these operations will be based on DOGM recommendations.

Over the life of the mine, soil / PGM will be removed from the area within the proposed disturbance boundary, a total of 44.7 acres. The volume of PGM stockpiled should range from 9,680 cubic yards to 29,040 cubic yards (assuming the PGM is removed from 6 acres of land annually).

### **IV. Rule R647-4-107 - Operation Practices**

During operations, the Operator shall conform to the practices listed under Rule R647-4-107 of the Minerals Rules.

There exist no known shafts or tunnels within the property boundary. If any are found during the course of mining, they will be guarded to prevent unauthorized or accidental entry in accordance with MSHA regulations.



Should any trash, scrap metal, wood, or other extraneous debris be generated, it will be placed into sealable containers and removed.

If any holes are drilled during exploration activities, they will be plugged from bottom to top to prevent the mixing of waters from the surface or subsurface. The surface of any drill holes will be plugged to prevent direct inflow of surface water and to eliminate the open-hole hazard. All plugging will be in compliance with State of Utah and BLM regulations.

During mining operations and non-operational times, if public safety hazards or conditions exist, then signs, fences, or other measures will be erected to identify them. If warranted, public access will be restricted from specific mining sites. The mining area will be flagged during active mining with wooden laths with colored biodegradable flagging tape. At the end of each campaign, the entrances to the dirt road from the paved highway will be bermed to restrict access to the diatomaceous earth pit and high walls will be reshaped to conform as best possible to surrounding topography. During mining operations, signs will be erected to warn the public that heavy machinery is in use.

Any high walls created during mining that would pose a public safety issue will be clearly marked and bermed.

No natural drainage channels exist within the proposed disturbance boundary.

The pit is hydrologically enclosed. Any pit erosion will be internal and be deposited into the bottom of the pit. The eroded material is diatomaceous earth and will be collected and used as mine material. Erosion outside the pit will be kept to a minimum using engineering designs, mechanical barriers, vegetation, etc. During non-operational periods, the slopes will be re-contoured to conform as best possible to surrounding topography, an application of PGM will be applied, and a seed mixture distributed to minimize erosion and other adverse impacts. The slope will be stabilized to minimize erosion and facilitate vegetation. The area will be maintained in a safe and clean manner.

All motor fuels and greases are currently stored within the vehicles. Any minor spills will be cleaned up and disposed of at the off-site truck maintenance shop. Any major spills will be reported and cleaned up via environmental contractors. No water, hazardous materials, or explosives will be used. No drilling fluid will be used. Any and all toxic materials will be collected and removed from Federal property and properly disposed of in accordance to Federal, State, and County regulations and laws.

Plant Growth Material (PGM) will be protected as described in Section 106.6.

After each mining campaign, the walls of the pit will be re-contoured to a 3:1 slope, i.e. three horizontal units to 1 vertical unit. The pit will be reshaped to blend with the pre-mining surrounding topography. The slopes will be ripped on contour to remove compaction, which will minimize erosion and enhance water harvesting needed to facilitate vegetation. The PGM will be applied over the surface of the re-contoured pit, and a seed mixture will be distributed over disturbed areas. The seed mixture will be approved by the BLM. As the pit will not be free draining, a variance is requested, as described in Section VIII.

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## **V. Rule R647-108 - Hole Plugging Requirements**

If any drill holes are drilled during exploration activities, they will be plugged top to bottom to prevent the mixing of waters from the surface or subsurface, and to eliminate the open hole hazard. Groundwater is of unknown depth or existence, but is estimated to be at a depth of at least +100 ft. Drill holes will be drilled to a maximum depth of 100 feet; therefore no encounter with groundwater is anticipated. All activities will be compliance with State of Utah regulations.

### **110.2 Reclamation of roads, high walls, slopes, leach pads, dumps, etc.**

High walls will be re-contoured to a slope of 3h:1v. The pit will be contoured to a broad, shallow depression. The pit surface will be reshaped to conform as best as possible to the approximate original contours. The pit surface will also be ripped to a depth of two feet prior to the placement of PGM. The recontoured pit will have a potential to be a temporary water impounding structure. A variance to allow this is requested in Section VII.

Stockpiled PGM will be applied over the re-contoured surface. An approved seed and fertilizer mixture will be distributed over disturbed areas through broadcast seeding.

Upon completion of mining, the crushed rock road base will be removed and hauled as product to another Holcim facility. Berms of diatomaceous earth along the sides of the road were constructed when the road was built. These are made of PGM and will be used in the final reclamation of the road. The road will be recontoured as best as possible to approximate original contours, becoming part of the pit to be left behind, as shown in Figure 105.5. The road will be reclaimed with the pit, according to the practice described above for the reclamation of the pit.

Any drill hole not consumed during mining will be reclaimed. Reclamation will be consistent with the rules for plugging drill holes (R-647-4-108). The drill hole will be covered with PGM, reseeded, and fertilized according to the practice described above for the reclamation of the pit.

All re-seeding and fertilizing will occur between October 1 and March 15 to take advantage of the cool season precipitation as recommended by the **DOGM**.

There will be no other impoundments or ponds on site. No drainage channels exist on the property. There will be no waste dumps, shafts, or adits on site. No tailings will be created, and there will be no leach pad on site. There will be no stockpiling of materials on site beyond the temporary stockpiling of PGM which will be used as a final application after reshaping of disturbed areas.

Reclamation will occur annually.

### **110.3 Surface facilities to be left**

No permanent or temporary structures exist.

Existing roads depicted on the topographic map USGS 7.5 minute quadrangle 'Terra, UT' from 1998 used by the Operator will not be reclaimed excepting Center Road, where it crosses the disturbance area. Reclamation will occur as described in Section 110.2 above.

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### **110.5 Revegetation planting program and topsoil redistribution**

Disturbed lands will be rough graded to re-establish contours and ripped to a depth of 24 inches for the preparation of seedbeds and revegetation. After contouring, the mining area will be a shallow depression with slopes of 3h:1v. Ripping (removal of soil compaction), the shallow slope and topographic low of the depression should minimize erosion. Should it be found necessary, appropriate stabilization methods will be used to control erosion and to stabilize slopes and disturbed lands.

#### **SOIL MATERIAL REPLACEMENT**

Soil will be removed prior to mining and temporarily stockpiled adjacent and contiguous to the mining site. During each mining campaign, the volume stockpiled should range from 9,680 cubic yards to 29,040 cubic yards (assuming the soil is 1-3 feet deep and removed from 6 acres of land). All soils stockpiled will be used for reclamation. Assuming a stockpile volume of 29,040 cubic yards, the volume stockpiled will provide a final cover about three feet thick.

#### **SOIL FERTILITY**

A soil survey to be completed next summer will test soil for fertility. Based on laboratory analysis and the success of areas currently undergoing revegetation, the need for fertilizers and other soil amendments will be determined. If soil supplements, fertilizers, or other amendments are required or desirable, they will be applied properly per the manufacturer's specifications or soil survey recommendations.

#### **SEEDBED PREPARATION**

PGM seedbeds will be prepared to facilitate seedling germination and establishment. Seedbeds will be left in a rough surface condition whenever possible. Areas will be seeded as soon as possible after completion of soil reconstruction. Physical soil manipulation and revegetation operations will be performed on the contour, to the fullest extent possible, to minimize potential surface erosion.

#### **SEEDING METHODS**

Reclamation of the mining area will be accomplished by planting a mixture of grasses approved by the DOGM and the US BLM. This seed mixture, shown in Table 110.1, is proposed for permanent revegetation of lands disturbed by mining. The proposed seed mixture recommended by the BLM was used in a Fire Rehabilitation project south and east of the mine. In addition to this mixture, a few extra seed types will be used as recommended by the DOGM/

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**Table 110.1 - Revegetation Seed Mixture**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Seeding Rate (lbs/Acre)</b>
Western Wheatgrass	<i>Pascopyrum smithii</i>	3.0
Crested Wheatgrass	<i>Agropyron cristatum</i>	3.0
Indian Ricegrass	<i>Achnatherum hymenoides</i>	1.0
Lewis Flax	<i>Linum lewisii</i>	1.0
Russian Wild Rye	<i>Psathyrostachys juncea</i>	2.0
Fourwing Saltbrush	<i>Atriplex canescens</i>	2.0
Palmer Penstemon	<i>Penstemon palmeri</i> Gray	0.25
Forage Kochia	<i>Kochia prostrate</i> (L.) Shred.	0.25

The seed will be broadcast as soon as possible after seedbed preparation is complete. Seedbed preparation and seeding will occur in the fall, no later than December 15 to take advantage of cool season precipitation as recommended by the DOGM.

Note: The areas being re-vegetated are in an arid and desert environment. Successful re-vegetation is dependent on the yearly amount of rain the area will receive. Should the first attempt at reseeding be unsuccessful, then additional applications and measures will be attempted.

#### **VIII. Rule R647-4-112 - Variance**

##### **112.1 Variance Request**

###### **112.1.1 The rule to which a variance is requested;**

The operator requests a variance from Rule R647-4-111.9 Dams and Impoundments.

###### **112.1.2 The variance requested and a description of the area that would be affected by the variance;**

The operator requests a variance to from Rule R647-4-111.9, which requires water impounding structures to be reclaimed so as to be self-draining and mechanically stable unless shown to have sound hydrologic design and to be beneficial to the post-mining land use. The variance would allow the post-reclamation contour of the pit to be that of a shallow depression with a slope of 3h:1 v that has the potential to become a temporary water impounding structure. The final proposed contours are depicted on Figure 105.5. The pit will be graded so that if any water becomes impounded, it will collect in only one end of the pit. This variance would encompass the entire proposed disturbance area.

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## IX. Rule R647-4-113 – Surety

The Operator has performed site-specific calculations to determine the cost to reclaim the site and determine the surety amount.

It is the operator's intent to reclaim after each campaign quarrying period. Each campaign will disturb approximately 7 acres, therefore at any one time only 7 acres could be left to be reclaimed. In addition, if the BLM requests the dirt roads be reclaimed, that cost would be incurred.

### Reclamation Cost Estimates, based on 2005 dollar values

- D8R bulldozer: Rental rate - \$135/hr; estimated operating cost - \$57.90/hr; Total cost - \$229.60/hr
- 980G front-end wheel loader with 7.5 yd<sup>3</sup> bolt-on edge general purpose bucket: Rental rate - \$100/hr; estimated operating cost - \$45.55/hr; Total cost - \$182.25/hr
- \$240/acre for broadcasting seed, including seed cost and equipment
- \$45.00 per hour for laborer in the field casting seed and fertilizer
- mobilization / demobilization for lowboy truck to transport heavy equipment
  - D8R Bulldozer - \$4.75/mile (trailer), \$1.00/mile (truck), \$100 for Oversized load permit
  - 980G Front-end loader - \$4.75/mile (trailer), \$1.00/mile (truck), no permit needed

### **Average Haul Distance:**

(calculated using methods from Handbook for Calculation of Reclamation Bond Amounts, U.S. Department of the Interior)

- D8R bulldozer
  - pit - 276 ft
  - road - 500 ft
- 980G front-end wheel loader
  - pit - 276 ft
  - road - 500 feet

### **Hourly production rates of equipment:**

(calculated using methods from Caterpillar performance handbook, edition 34)

- D8R bulldozer with "U" blade @ 85% efficiency
  - Contouring pit and high walls - 595 LCY/hr
  - Pushing and spreading PGM over pit - 595 LCY/ hr
  - Pushing and spreading PGM over road - 180 LCY/hr
  - Ripping pit (with 3 shank ripper) - 3,300 BCY/ hr
  - Remove PGM from road - 180 LCY/hr
  - Remove and contour road - 180 LCY/hr
  - Grading - 9.4 acres/ hr
  - Ripping road (with 3 shank ripper) - 3690 BCY/hr

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- 980G front-end wheel loader with 7.5 yd<sup>3</sup> bolt-on edge general purpose bucket @ 85% efficiency
  - work in pit - 191 LCY/hr
  - work on road - 118 LCY/hr

**Earthmoving costs (including fuel and labor):**

1. Contour and remove high walls:

Equipment	Volume (LCY)	Prod Rate (LCY/hr)	Hours	Cost (\$/hr)	Total
980G Front end loader	70,000	191	183	\$182.25	\$33,352.00
D8R dozer, "U" blade	70,000	595	59	\$229.60	\$13,546.00
Contour and high wall removal Subtotal:					<b>\$46,898.00</b>

Safety gates, signs, etc. (mtls) **\$250.00**

2. Ripping the pit to a depth of 24 inches

Equipment	Volume (LCY)	Prod Rate (LCY/hr)	Hours	Cost (\$/hr)	Total
D8R dozer, 3 shank ripper	22,570	3,300	7	\$229.60	\$1,607.00
Ripping Subtotal:					<b>\$1,607.00</b>

3. Push and Spread PGM as final cover:

Equipment	Volume (LCY)	Prod Rate (LCY/hr)	Hours	Cost (\$/hr)	Total
980G Front end loader	29,040	191	77	\$182.25	\$14,033.00
D8R dozer, "U" blade	29,4040	595	25	\$229.60	\$5,740.00
Push and Spread as final cover					<b>\$19,773.00</b>

4. Grading after applying PGM:

Equipment	Prod Rate Acres	(Acres/hr)	Hours	Cost (\$/hr)	Total
D8R dozer, "U" blade	7	9.4	0.7	\$229.60	\$ 161.00
Grading after applying PGM					<b>\$ 161.00</b>
Earthmoving Costs Total:					<b>\$65,689.00</b>

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**Revegetation costs:**

## 1. Seed Cost per Acre

Broadcast seeding: 8 acres @ \$240 /acre  
 8 acres \* \$240 /acre = \$1,920.00      Seed Cost Subtotal: \$1,920.00

## 2. Cost of Labor

One Laborer working 8 hours @ \$45.00 per hour  
 8 hours \* \$45.00 /hour = \$360.00      Labor Subtotal: \$360.00

<i>Revegetation cost totals</i>	Cost/Acre	Number of Acres	Total per Unit
Subtotals			
Seed Costs	\$ 240.00	8	\$ 1,920.00
Laborer Costs	\$45/hr	9	\$ 405.00
Revegetation Costs Total:			<b>\$ 2,325.00</b>

**Mobilization / Demobilization:**

Distance from Wheeler Machinery to location of quarry = 80 miles

Equipment	Rate (\$ /mi) (Trailer)	Rate (\$/m) (Truck)	Trailer Cost	Truck Cost	Total
980G Front-end loader and D8R dozer	\$5.75	\$1.00	\$320	\$1840	\$ 1840.00
Mobilization subtotal (one-way)					\$ 2040.00
Oversized load Permit					\$ 100.00
Mobilization Total (One-Way)					\$1,020.00
Mobilization / Demobilization Total (2 One Way Mobilizations @ \$1,020.00):					<b>\$2,040.00</b>

**Total Reclamation Costs for 8 acres:**

Earthmoving Costs Subtotal	\$65,689.00
Revegetation Costs Subtotal	\$ 2,325.00
Mobilization / Demobilization Subtotal	\$2,040.00
Total for 8 acres	\$70,054.00
Total per acre \$70,054.00 / 8)	\$8756.75 /acre



### Reclamation of Dirt Road

The road is 14 feet wide and 1000 feet long within the disturbed area.

#### 1. Removing PGM berms from road

Equipment	Volume (LCY)	Prod Rate (LCY/hr)	Hours	Cost (\$/hr)	Total
D8R Dozer, "U" blade	3,015	180	17	\$229.60	\$ 3,903.00
PGM removal subtotal:					<b>\$ 3,903.00</b>

#### 2. Remove and contour road

Equipment	Volume (LCY)	Prod Rate (LCY/hr)	Hours	Cost (\$/hr)	Total
980G Front-end loader	23,228	191	122	\$182.25	\$22,235.00
D8R Dozer, "U" blade	23,228	180	129	\$229.60	\$29,618.00
Remove and contour road subtotal:					<b>\$51,853.00</b>

#### 3. Ripping the road to a depth of 24 inches

Equipment	Volume (BCY)	Prod Rate (BCY/hr)	Hours	Cost (\$/hr)	Total
D9R dozer, 3 shank ripper	1,037	3,690	0.28	\$229.60	\$ 64.00
Ripping Subtotal:					<b>\$ 64.00</b>

#### 4. Spreading PGM over the Road

Equipment	Volume (LCY)	Prod Rate (LCY/hr)	Hours	Cost (\$/hr)	Total
D8R dozer, "U" blade	3015	180	17	\$229.60	\$ 3,903.00
Spreading PGM over Road Subtotal:					<b>\$ 3,903.00</b>

#### 5. Grading Road

Equipment	Volume (Acres)	Prod Rate (Acres/hr)	Hours	Cost (\$/hr)	Total
D8R dozer, "U" blade	1	9.4	0.11	\$229.60	\$ 25.00
Grading Road Subtotal:					<b>\$25.00</b>

Reclamation of Dirt Road One Time Total: **\$59,748.00**

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General site cleanup and trash removal: 3 acres	\$75.00	<b>\$225.00</b>
Reclamation supervision – 10% of reclamation estimate		<u>\$13,302.00</u>
	Subtotal	\$146,330.00
10% Contingency		<u>\$14,633.00</u>
	Subtotal	\$160,963.00
Escalate for 5 years at 1.2% per year		<u>\$9893.00</u>
Total		\$170,856.00
<b>Rounded surety amount in year 2010</b>		<b>\$170,900.00</b>

Sources:

Caterpillar performance handbook, edition 34  
Davis Bacon Act Wage Determinations Website  
[http://www.access.gpo.gov/davisbacon/davbacsearch.ht](http://www.access.gpo.gov/davisbacon/davbacsearch.htm)  
Granite Seeds (seed pricing)  
Wheeler Machinery (mobilization/demobilization estimate)



Holcim, Inc  
Vegetation and Soil Baseline Assessment

Skull Valley Mine

Prepared for:  
Holcim, Inc  
6055 E Croydon Rd  
Morgan, UT 84050

Prepared by:  
WP Natural Resource Consulting, LLC  
PO Box 520604  
SLC, UT 84152

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## INTRODUCTION

Holcim, Inc is required to submit a new LMO to the State of Utah Division of Oil Gas and Mining (DOGM) to continue mining operations at the Skull Valley mine. The purpose of this report is to provide a baseline characterization of soils and vegetation according to the requirements set forth by DOGM as listed on Form MR-LMO. This information will assist in the design of a site appropriate and effective reclamation plan.

## SITE DESCRIPTION

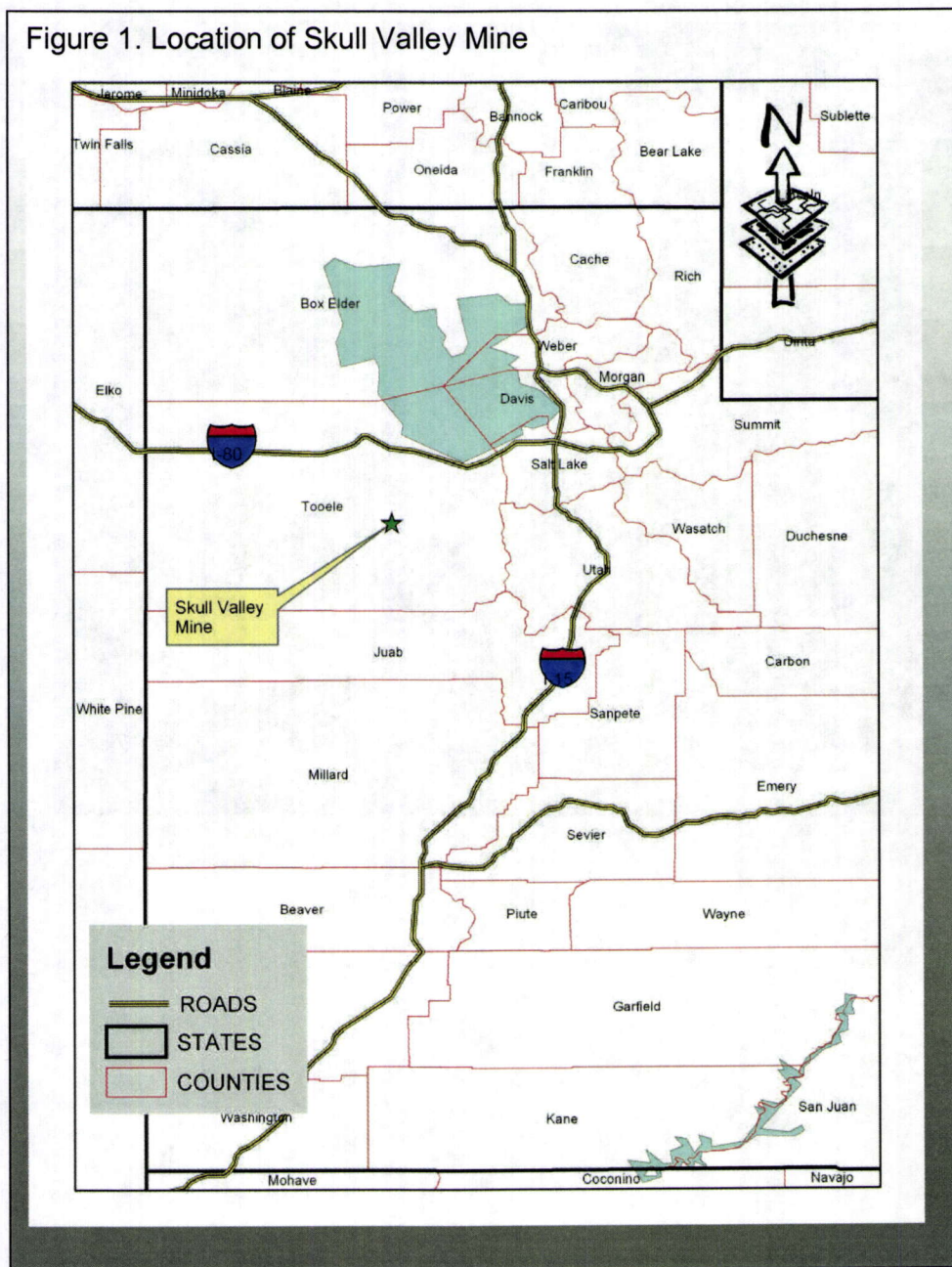
### VEGETATION

The mine property is located approximately 35 miles south of Timpie on Interstate 80 within Skull Valley in Tooele County, Utah. The mine is in T6S R7W Section 7. The Skull Valley area receives between 8 and 10 inches of precipitation annually. Precipitation amounts are generally evenly distributed throughout the year with the exception of heavier precipitation in May (average of 1.06 inches). Slopes in the area are generally very gentle at 2-4%. The present vegetation of the area is a mix of Wyoming big sagebrush (*Artemisia tridentata* var *wyomingensis*) and greasewood (*Sarcobatus vermiculatus*). The understory as present in May of 2005 consisted chiefly of cheatgrass (*Bromus tectorum*), with a few plants of crested wheatgrass (*Agropyron cristatum*) and globemallow (*Sphaeralcea munroana*). The vegetation in the area has been disturbed over decades from grazing and other forms of agriculture. Native vegetation likely would have been stands of Wyoming sagebrush with some greasewood and shadscale (*Atriplex confertifolia*), with an understory of native perennial grasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Oryzopsis hymenoides*), and bluegrass (*Poa secunda*). Vegetation cover is 45.5% +/- 11.9%. This estimates include cheatgrass cover. If cheatgrass cover is not included, the vegetation cover averages 13.3 +/- 3.7%. The vegetation community of this area is somewhat typical of the Great Basin as a whole. Cheatgrass so aggressively harnesses the early spring moisture and soil nutrients to the point where native vegetation is unable to successfully compete. Revegetation in these areas generally is difficult due to the abundance of cheatgrass. Due to the relatively wet year of 2004-2005, the cheatgrass was especially robust in the spring of 2005. Figure 1 depicts the location of the Skull Valley Mine and Figure 2 shows an overview of the vegetation community in the mine area.





Figure 1. Location of Skull Valley Mine



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Figure 2. Overview of vegetation community at Skull Valley Mine.





## SOILS

The Tooele Area soil survey covers the area of the Skull Valley Mine and was published in 1992 by the Natural Resource Conservation Service. This soil survey was used in conjunction with soil tests from 3 points to ascertain the character of the soils in the area. Soil samples were sent to the USU soils laboratory to determine pH, EC, CEC, %OM, N, P, SAR and K (see Figure 4 for soil type locations).

According to the soil NRCS soil survey, the Medburn fine sandy loam on 2-4% slopes (designated # 43 on Figure 4) covers the entire Skull Valley mine. These soils are generally very deep and well drained and are located on lake terraces and fan remnants formed from alluvium and lacustrine sediments. These soils are generally saline with EC (electroconductivity) and sodium absorption ratio values increasing with depth (2-16 mmhos/cm and 13-30 respectively from the surface to 60 inches depth). The NRCS soil describes this soil type as having chiefly species that are tolerant of high saline conditions such as greasewood, seepweed and shadscale. However, as with most soil types, there are inclusions of different soils within the Medburn fine sandy loam. The Taylorsflat soil type is found in similar landscape positions (gentle slope) and the Hiko Peak type is found in drainages within the Medburn fine sandy loam. Additionally, the Medburn fine sandy loam that are located on 2-8% slopes are also found adjacent to the mining site (number 42 on Figure 4). Since the soil survey was completed at a relatively large scale, delineating all inclusions is impractical.

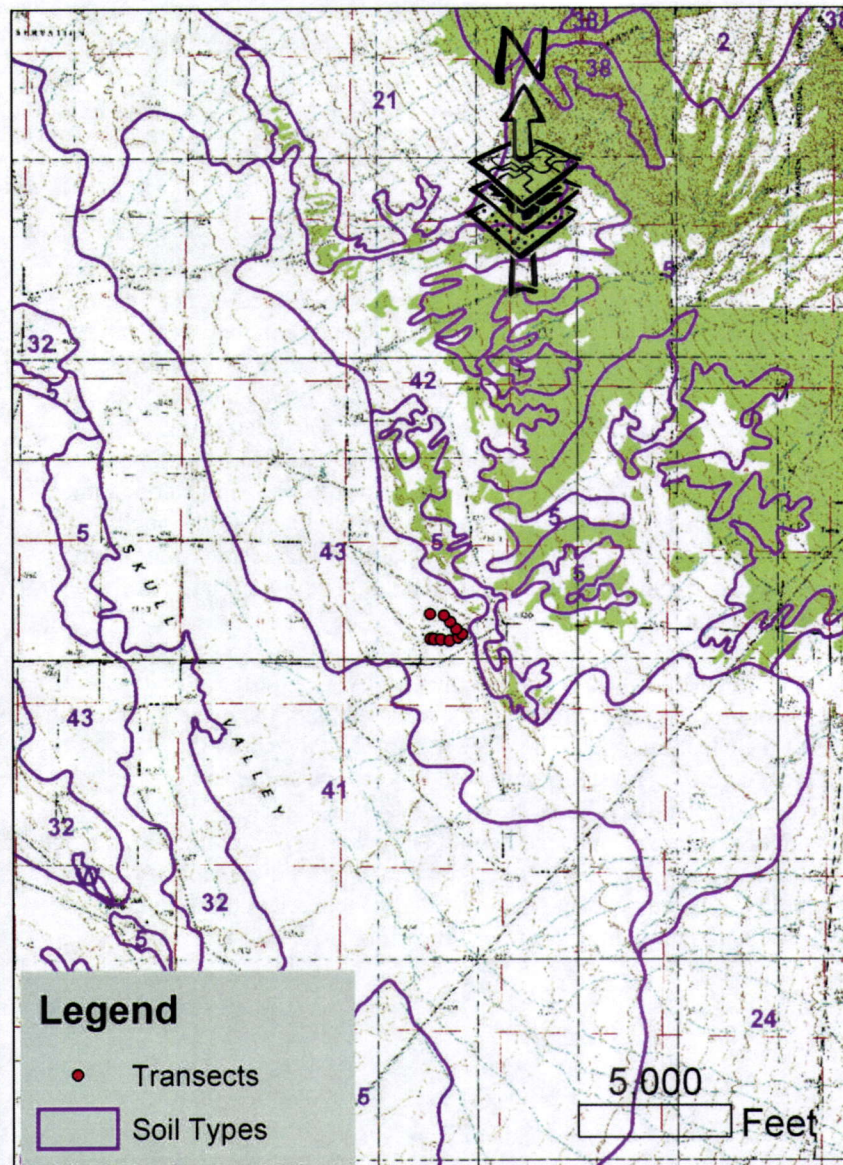
Much of the area of the Skull Valley Mine site are likely underlain by Medburn sandy loam. The presence and abundance of Wyoming sagebrush in the undisturbed areas of the mine indicates the soil is not as saline as some of the Medburn soils. The three soil tests analyzed by the USU laboratories did not show excess salinity. However, only the top 8 inches of the soil profile were sampled where the soil is not as saline and alkaline. The surface layer is typically about 8 inches thick and is a pale brown sandy loam. From 8 inches to about 60 inches in depth, the soil is a light yellowish brown fine sandy loam. The soil has a low to moderate water holding capacity and permeability is moderately rapid. Soil samples were taken from the stock pile at the east end of the active mine, around transect 8, and near transect 9 (see Appendix B for soil test results).

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Figure 4. Soil Type Boundaries



## METHODS

Data on vegetation cover and species richness (diversity) was collected on May 26, 2005. To ascertain the range of variability for vegetation cover, ground cover, and species composition, 10 transects of 100 feet in each vegetation type were established in areas determined to be representative of each of the vegetation types in the area that are likely to be disturbed by mining operations. Once within a stand of typical vegetation, a pin was spun to randomly determine the azimuth of the transect. Every foot, a point was taken and recorded (plant species, rock, litter, bare ground or gravel). This determines aerial cover, thus total ground cover plus bare ground





## *Skull Valley Soil and Vegetation Baseline Assessment*

must be equal to 100%. Data from the 10 transects in each of the vegetation types were then tabulated to determine the average and standard deviation of the cover offered by vegetation, rock, gravel, bare ground, and litter. Additionally, relative cover of each species was calculated to determine the relative amounts of each species and life form types (e.g. shrubs, perennial grasses, annual grasses, etc). See Table 1 for complete tabulated results.

Vegetation species that were encountered outside transect boundaries were also recorded. Vegetation cover was calculated both including the non-native annual grasses and excluding them. In many cases, the inclusion of weedy annual grasses in vegetation cover give artificially high cover values since it is better able to germinate and establish than its native counterparts.

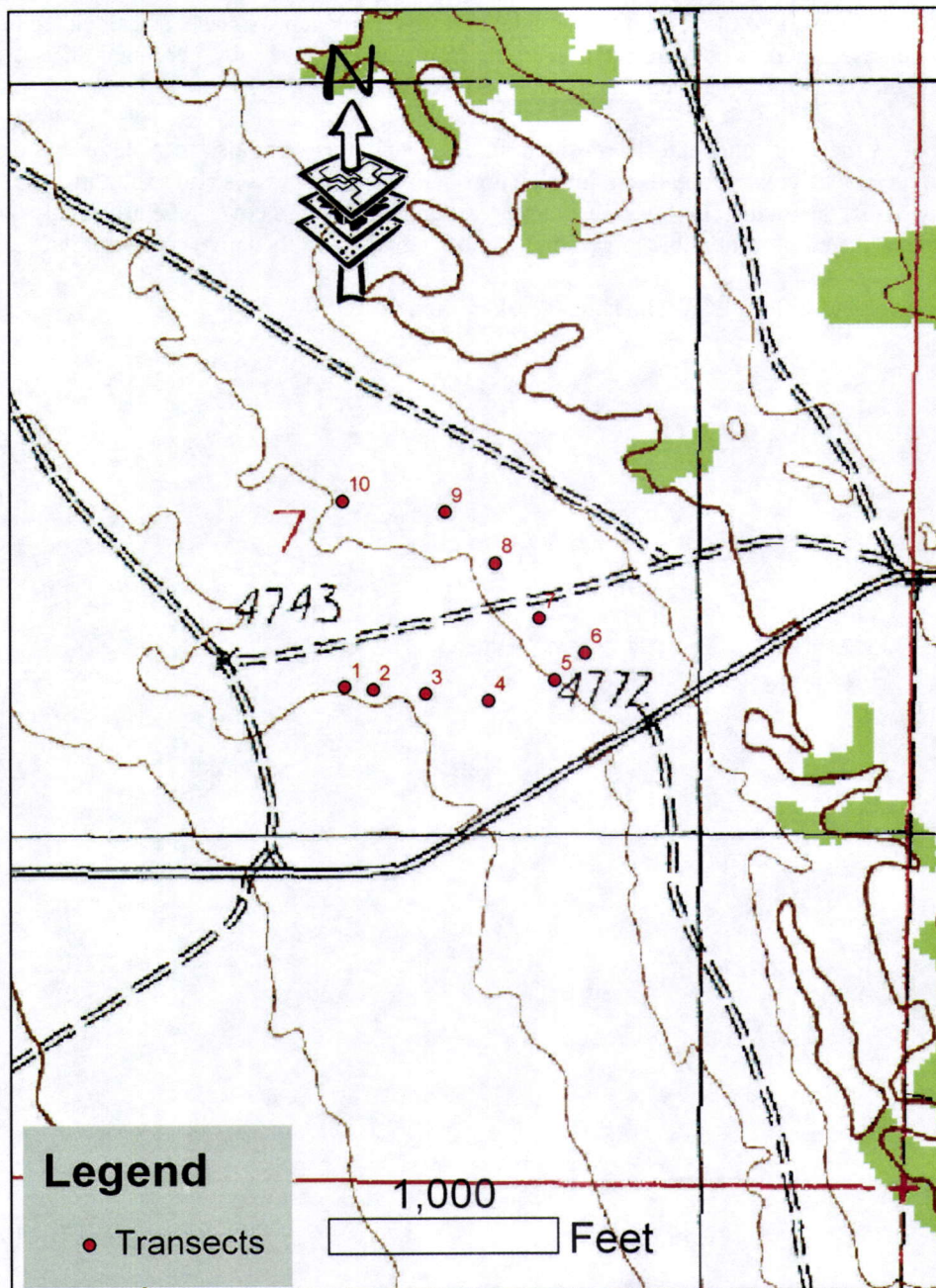
Vegetation nomenclature follows Welsh et al., A Utah Flora (1993).



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Figure 5. Vegetation transect locations





## RESULTS

Vegetation cover was tabulated both including and excluding annual non-native grasses. Non-native annual grasses can give artificially high vegetation cover estimates, since they are better able to establish than their native counterparts in the interspaces of the vegetation community. The area had a cover of 45.5% +/- 11.9% including non-native annual grasses. Annual grasses accounted for over half of the vegetation cover (69% relative cover). Shrubs accounted for about 24% of the vegetation cover. Wyoming sagebrush accounted for 17.4% of the vegetation cover while greasewood was almost 6% of the vegetation cover and spiny hopsage (*Grayia spinosa*) was only about 1%. Crested wheatgrass accounted for only 0.43% of the vegetation cover. Litter accounted for about 33% of the total cover, and bare ground was about 21% of the total cover.

If non-native annual grasses are not included in the vegetation cover estimates, the average vegetation cover is only 13.3% +/- 3.7%.

See Table 1 for complete tabulated results.

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Table 1. Tabulated vegetation cover for the Skull Valley Mine.

	ScientificName	Mean	StDev	StErr	Low	High	RelCover	Freq
Total Vegetation Cover	Total Vegetation Cover	45.500	11.947	3.778	32.000	62.000		100.00
Litter	Litter	32.800	7.871	2.489	23.000	45.000		100.00
Bare Soil	Bare Soil	20.800	9.235	2.920	9.000	40.000		100.00
Total Ground Cover	Total Cover	79.200	9.235	2.920	60.000	91.000		100.00
Introduced perennial grasses								
Crested wheatgrass	Agropyron cristatum	0.200	0.632	0.200	0.000	2.000	0.43	10.00
Annual grasses								
Cheatgrass	Bromus tectorum	32.200	9.693	3.065	21.000	47.000	69.25	100.00
Perennial forbs								
Globemallow	Sphaeralcea munroana	0.000	0.000	0.000	0.000	0.000	0.00	10.00
Annual and biennial forbs								
Jim Hill mustard	Sisymbrium altissimum	2.800	4.614	1.459	0.000	11.000	6.02	30.00
Shrubs								
Big Sagebrush	Artemisia tridentata	8.100	5.238	1.656	0.000	15.000	17.42	90.00
Spiny hopsage	Grayia spinosa	0.500	1.581	0.500	0.000	5.000	1.08	10.00
Greasewood	Sarcobatus vermiculatus	2.700	3.129	0.989	0.000	8.000	5.81	60.00
<b>Sub-total</b>		<b>11.300</b>					<b>24.30</b>	



## DISCUSSION

The soils underlying the vegetation communities within Skull Valley can be very problematic when attempting to revegetate the area due to its salinity and low organic matter content. Although the soil tests did not show excess salinity, only the top 8 inches were collected for analysis. The upper 8 inches of this soil profile are not characterized as overly saline. Salinity and alkalinity increase with depth in the Medburn soils. Salinity and alkalinity allows for a very limited suite of species to survive due to its salt content. It will likely be necessary to add soil amendments in order to achieve successful revegetation. Additionally, it will likely be helpful to salvage topsoil for future reclamation as this part of the soil profile is less problematic for seed germination and plant establishment. During mining operations, it is best to store the topsoil in a stock pile separate from the subsoils for this reason.

In order to achieve successful revegetation of this area, a combination of soil amendments (e.g. composted manure, etc), direct hauled topsoil and the following seed mix is recommended.

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*Skull Valley Soil and Vegetation Baseline Assessment*

Table 2. Recommended seed mix for Skull Valley

Common Name	Scientific Name	Variety	PLS lbs	Seeds/ lb	Percent of mix
<b>GRASSES</b>					
Sandberg's bluegrass	<i>Poa secunda</i>		0.5	925,000	13.5
Indian ricegrass	<i>Oryzopsis hymenoides</i>	Nezpar	5	141,000	20.5
Bluebunch wheatgrass	<i>Elymus spicatus</i>	P-7	3	140,000	12.2
Bottlebrush squirreltail	<i>Elymus elymoides</i>		5	192000	28
<b>FORBS</b>					
Globemallow	<i>Sphaeralcea munroana</i>		0.5	500,000	7.3
<b>SHRUBS</b>					
Wyoming sagebrush	<i>Artemisia tridentata</i> var <i>wyomingensis</i>		0.25	64,900	18.3
<b>TOTAL</b>			14.25		

This seed mix averages to about 78 seeds per square foot.





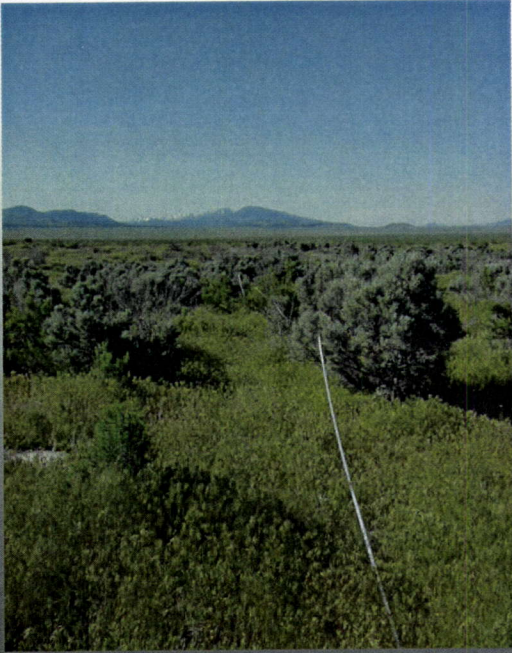
## APPENDIX A – PHOTOS OF SELECTED VEGETATION TRANSECTS

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**Transect 1**



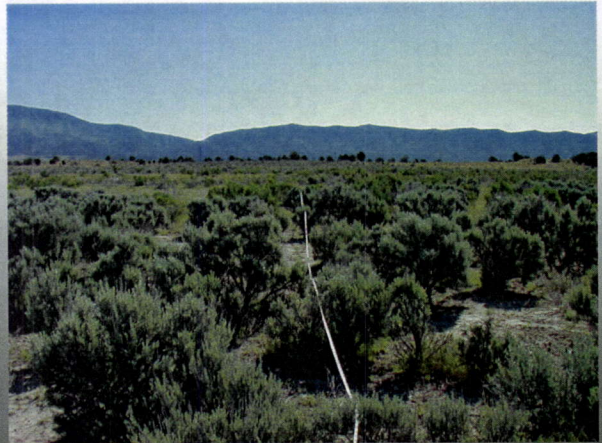
**Transect 6**



**Transect 2**



**Transect 4**



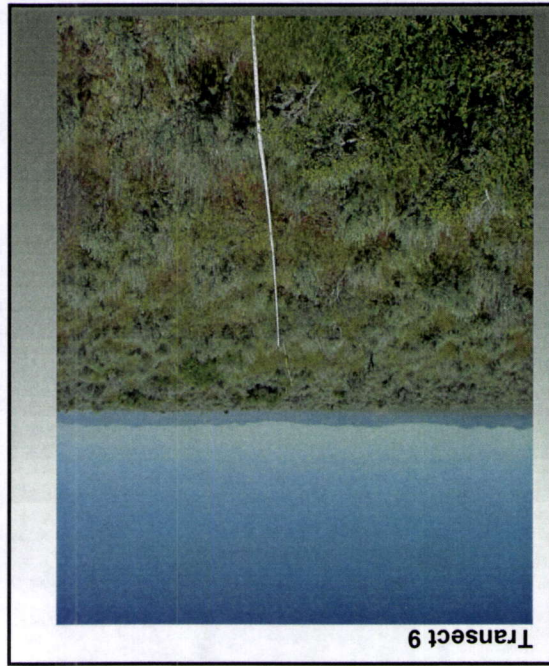


## APPENDIX B- SOIL TEST RESULTS

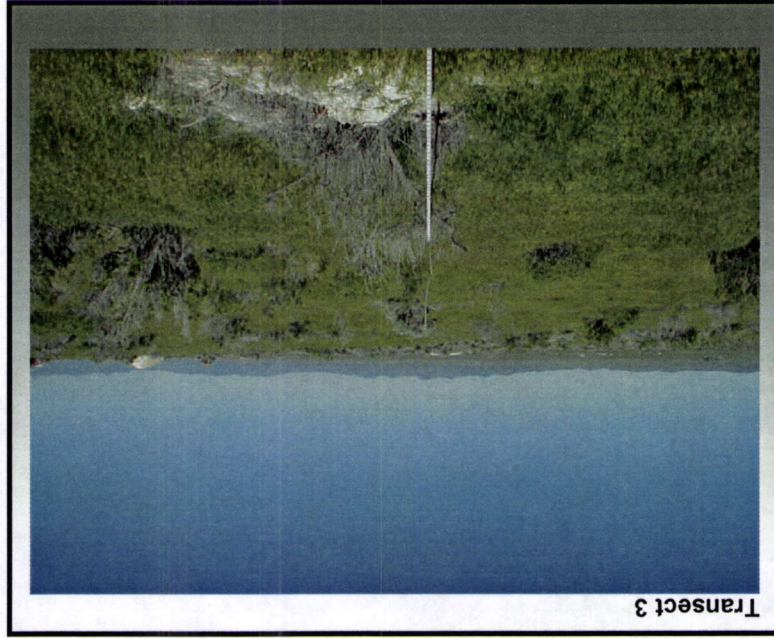
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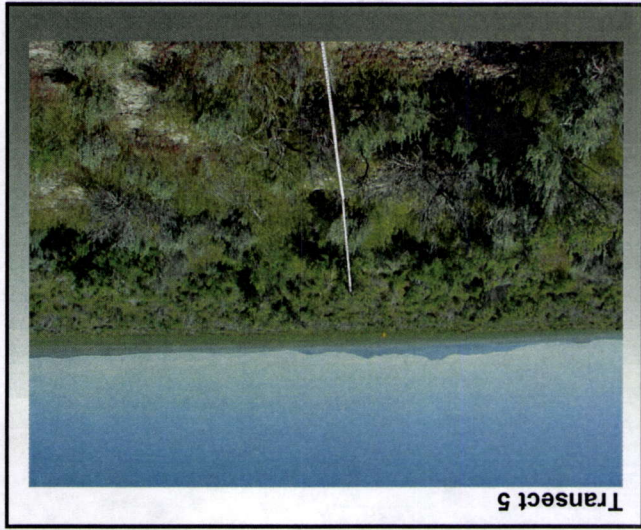




Transect 9



Transect 3



Transect 5





*Skull Valley Soil and Vegetation Baseline Assessment*

**Soil Test Report  
and  
Fertilizer Recommendation**

**USU Analytical Labs**

Utah State University  
Logan, Utah 84322-4830  
(435) 797-2217  
(435) 797-2117 (FAX)  
www.usual.usu.edu

Date Received: 7/18/2005  
Date Completed: 8/1/2005

Name: MINDY WHEELER  
Address: 4203 SUNRISE DR  
  
PARK CITY UT 84098

Phone: 801-699-5459  
County:

Lab Number: 5011615      Grower's Comments:      Acres in Field:  
Identification: 5-25-05 TRANSECT 9 & D A  
Crop to be Grown:

Soil Test Results			Interpretations	Recommendations
Texture	Sandy Loam			
pH		8.1	Normal	
Salinity - E <sub>Ce</sub>	dS/m	0.25		
Phosphorus - P	mg/kg	6.2		
Potassium - K	mg/kg	133		
Nitrate-Nitrogen - N	mg/kg	3.39		
Zinc - Zn	mg/kg			
Iron - Fe	mg/kg			
Copper - Cu	mg/kg			
Manganese - Mn	mg/kg			
Sulfate-Sulfur - S	mg/kg			
Organic Matter	%	1.0		
SAR		0.87	Soil Not Sodic	

**Notes**

CEC: 6.4

CONTACT THE LAB WITH WHAT YOU ARE GROWING FOR RECOMMENDATIONS

For further assistance, please see your County Agent



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# Skull Valley Soil and Vegetation Baseline Assessment

## Soil Test Report and Fertilizer Recommendation

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County:

Lab Number: 5011615      Grower's Comments:      Acres in Field:  
Identification: 5-25-05 TRANSECT 9 & D A  
Crop to be Grown:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		8.1	Normal	
Salinity - ECe	dS/m	0.25		
Phosphorus - P	mg/kg	6.2		
Potassium - K	mg/kg	133		
Nitrate-Nitrogen - N	mg/kg	3.39		
Zinc - Zn	mg/kg			
Iron - Fe	mg/kg			
Copper - Cu	mg/kg			
Manganese - Mn	mg/kg			
Sulfate-Sulfur - S	mg/kg			
Organic Matter	%	1.0		
SAR		0.87	Soil Not Sodic	

#### Notes

CEC: 6.4  
CONTACT THE LAB WITH WHAT YOU ARE GROWING FOR RECOMMENDATIONS

For further assistance, please see your County Agent.



WP Natural Resource Consulting, LLC



*Skull Valley Soil and Vegetation Baseline Assessment*

Soil Test Report  
and  
Fertilizer Recommendation

**USU Analytical Labs**

Utah State University  
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Date Completed: 8/1/2005

Name: MINDY WHEELER  
Address: 4203 SUNRISE DR

Phone: 801-699-5459

PARK CITY UT 84098

County:

Lab Number: 5011617

Grower's Comments:

Acres in Field:

Identification: 5-26-05 TRANSECT B AREA

Crop to be Grown:

Soil Test Results			Interpretations	Recommendations
Texture		Sandy Loam		
pH		8.3	Normal	
Salinity - ECe	dS/m	0.35		
Phosphorus - P	mg/kg	7.3		
Potassium - K	mg/kg	310		
Nitrate-Nitrogen - N	mg/kg	2.47		
Zinc - Zn	mg/kg			
Iron - Fe	mg/kg			
Copper - Cu	mg/kg			
Manganese - Mn	mg/kg			
Sulfate-Sulfur - S	mg/kg			
Organic Matter	%	1.2		
SAR		2.57	Soil Not Sodic	

Notes

CEC: 8.3

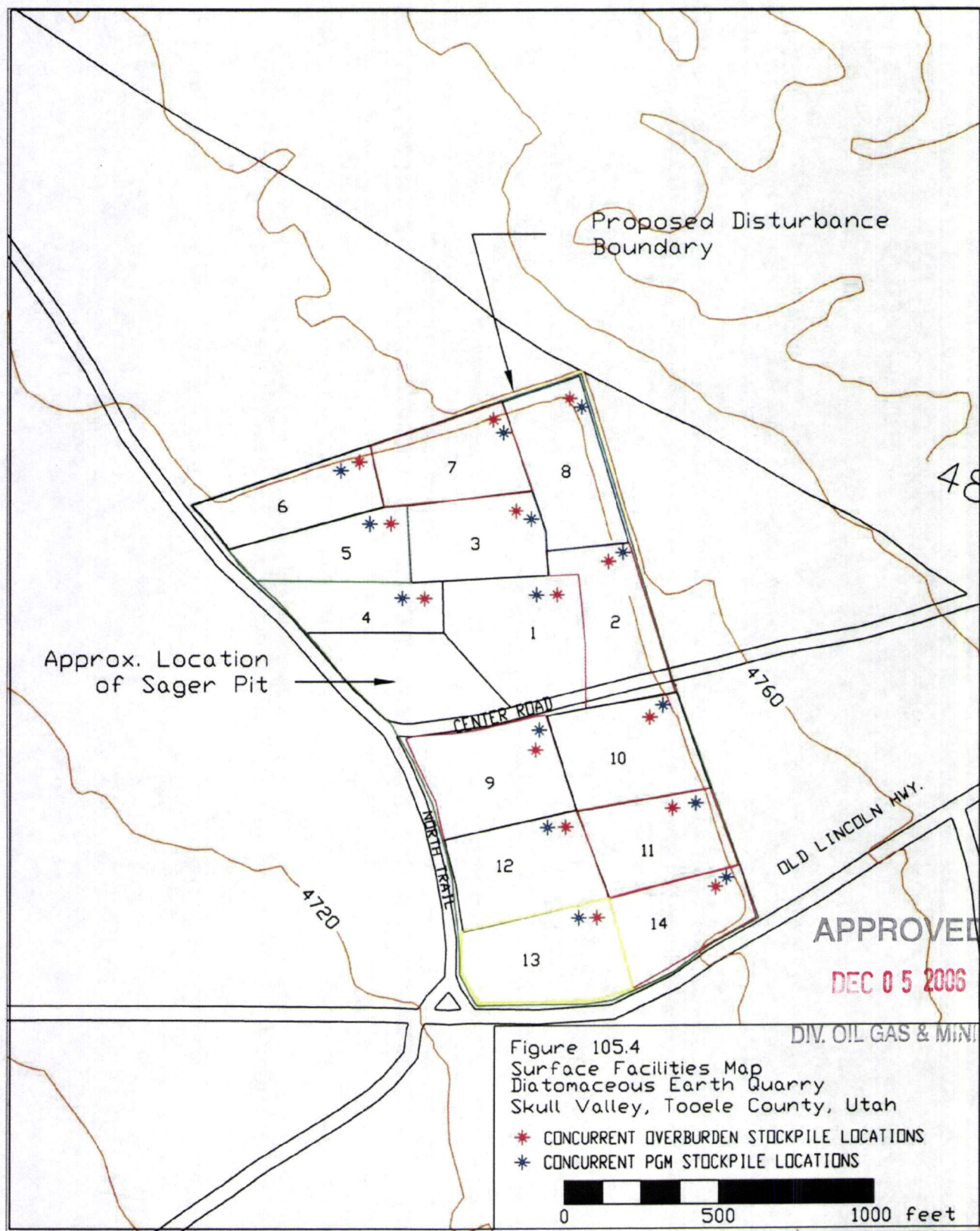
CONTACT THE LAB WITH WHAT YOU ARE GROWING FOR RECOMMENDATIONS

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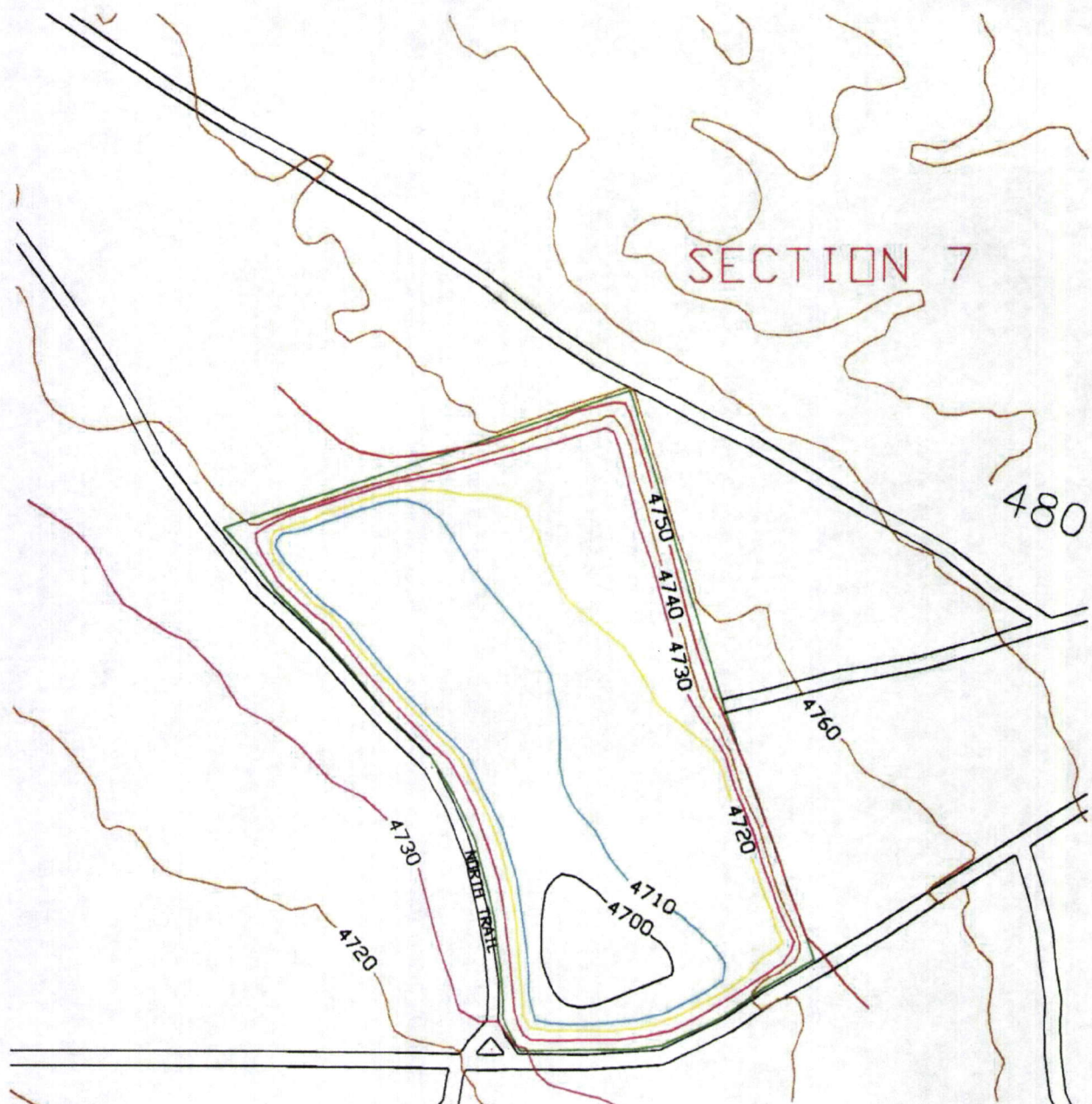


FIGURE 105.5  
DIATOMACEOUS EARTH TOOELE COUNTY, UT  
RE-CONTOURED WITHOUT CENTER ROAD  
FINAL PROPOSED CONTOURS

0 500 1000 feet

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SHEET 1 OF 1



DRAWN BRIAN WARD

CHECKED TOM NEWMAN

SCALE: 1"=500'



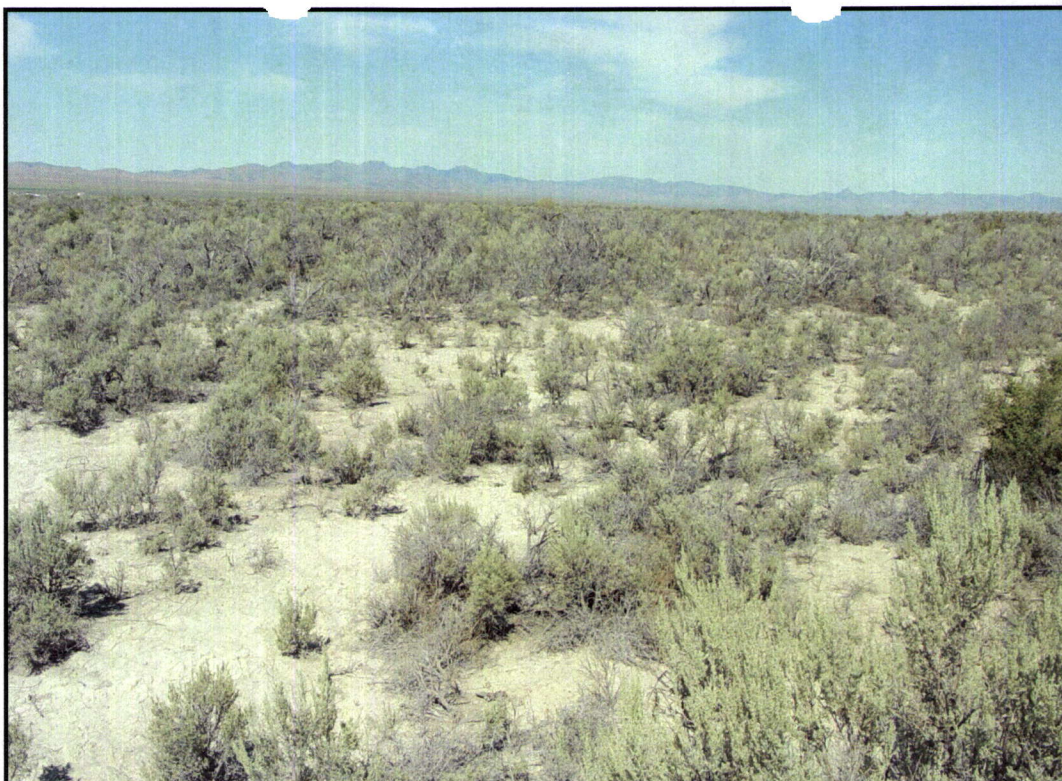


Figure 106.1 (a)

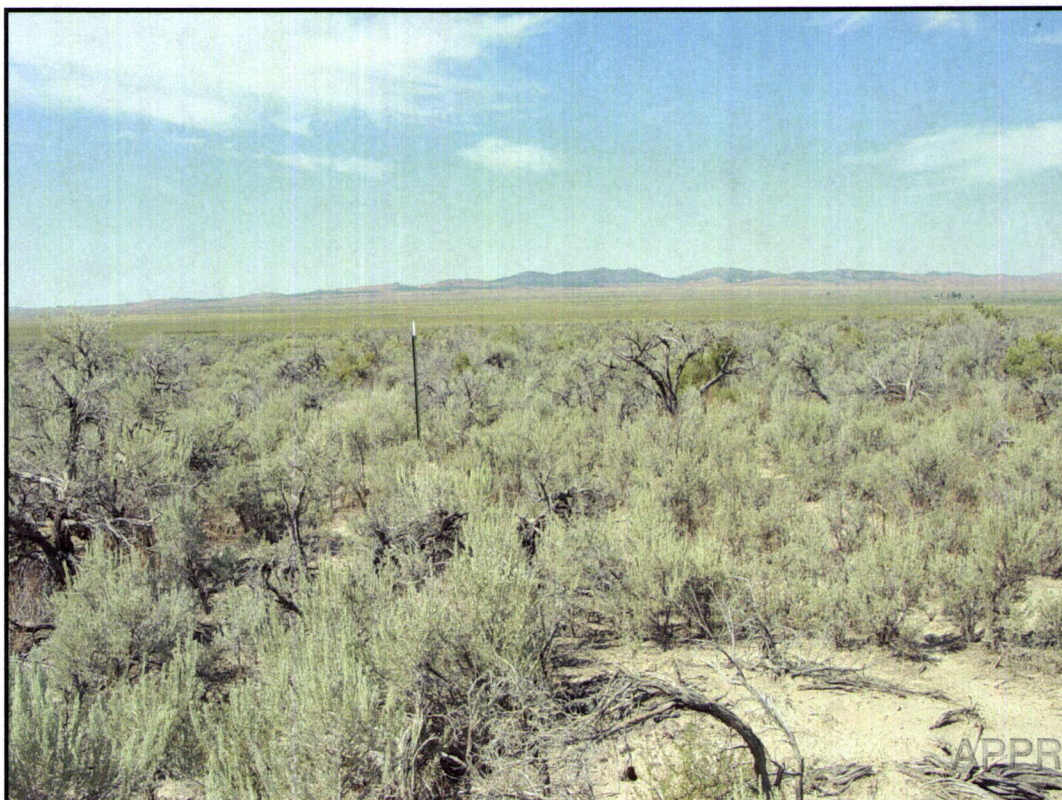


Figure 106.1 (b)

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Figure 106.1 – Photographs of Vegetation in Skull Valley taken August 12, 2004  
(a) – Looking West from Sager Pit; (b) – Looking North from North edge of Holcim Pit